

SysML Overview

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SysML Submission Team

Topics

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 - INCOSE/OMG
 - SysML Collaborators
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 - UML Reuse
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 - AP233 Alignment



Background

Motivation

- Systems Engineers need a standard language for analyzing, specifying, designing, verifying and validating systems
- Many different modeling techniques
 - Behavior diagrams, IDEF0, N2 charts, ...
- Lack broad-based standard that supports general purpose systems modeling needs
 - satisfies broad set of modeling requirements (behavior, structure, performance, ...)
 - integrates with other disciplines (SW, HW, ..)
 - scalable
 - adaptable to different SE domains
 - supported by multiple tools

Why UML for SE ?

- De facto standard for software engineering
 - Tools and training are widely available, mature
- Extensible and adaptable to support SE requirements
 - Not just for software modeling.
 - Wide lifecycle, including logical specifications and deployment.
 - Behavior models with virtual machines.
 - More than pictures:
 - Includes a repository model/API and
 - ... and XML interchange.
- OMG standardization process supports UML customization for specific domains (e.g., systems engineering)

INCOSE/OMG Joint Initiative

- OMG Systems Engineering Domain Special Interest Group chartered by INCOSE-OMG initiative in 2001
- Extend UML for specifying, designing, and verifying complex systems
- Provide capability for rigorous transfer of specifications among tools used by systems, software and hardware engineers
- Bridge the semantic gap, the professional engineering discipline gap, and the training gap that exists between systems engineering and software engineering
- Create a semantic bridge between ISO 10303-233 standard and ISO/IEC 19501 UML standard

SE DSIG Tasks

- Drafted UML for SE RFI, issued by OMG in 2002 to validate SE usage and limitations
- Supported development of SE concept model
- Collaborated with UML 2 submission teams
- Performed detailed requirements analysis
- Drafted UML for SE Request for Proposal, issued by the OMG in March 2003 (ad/03-03-41)
- Extensive coordination with OMG, INCOSE, and ISO AP233 WG

SysML Collaborators

- Partnership of modeling tool users, vendors, and government agencies.
 - Organized in May 2003 to respond to UML for Systems Engineering RFP
 - Industry
 - Lockheed Martin, Raytheon, Northrop Grumman, Boeing, BAE SYSTEMS, Motorola, Deere & Company, Eurostep, American Systems, Astrium Space, Israel Aircraft Industries, oose.de, THALES
 - Government
 - DoD/OSD, NASA/JPL, NIST
 - Tool Vendors
 - IBM/Rational, Telelogic, Vitech, Artisan, I-Logix, Popkin, Project Technology, Gentleware, Ceira, PivotPoint Technology, 3SL, EmbeddedPlus
 - Liaisons
 - AP233, CCSDS, EAST, INCOSE, Rosetta

Stakeholder Review & Feedback

Process

■ SysML Development

- Writing initial submission 5-12/04
- INCOSE review 1/04
- Initial submission to OMG 2/04
- INCOSE review 5/04
- Extensive coordination with UML 2 FTF
- Revised submission 10/04
- Publications
 - INCOSE Symposium 2003, 2004 papers
 - INCOSE Insight article
 - INCOSE Journal article
 - Product Development Journal article
- Initial vendor prototypes were favorably received during MDSD WG demo at INCOSE Symposium, 7/05
 - Artisan, EmbeddedPlus, I-Logix, Telelogic



SysML Overview

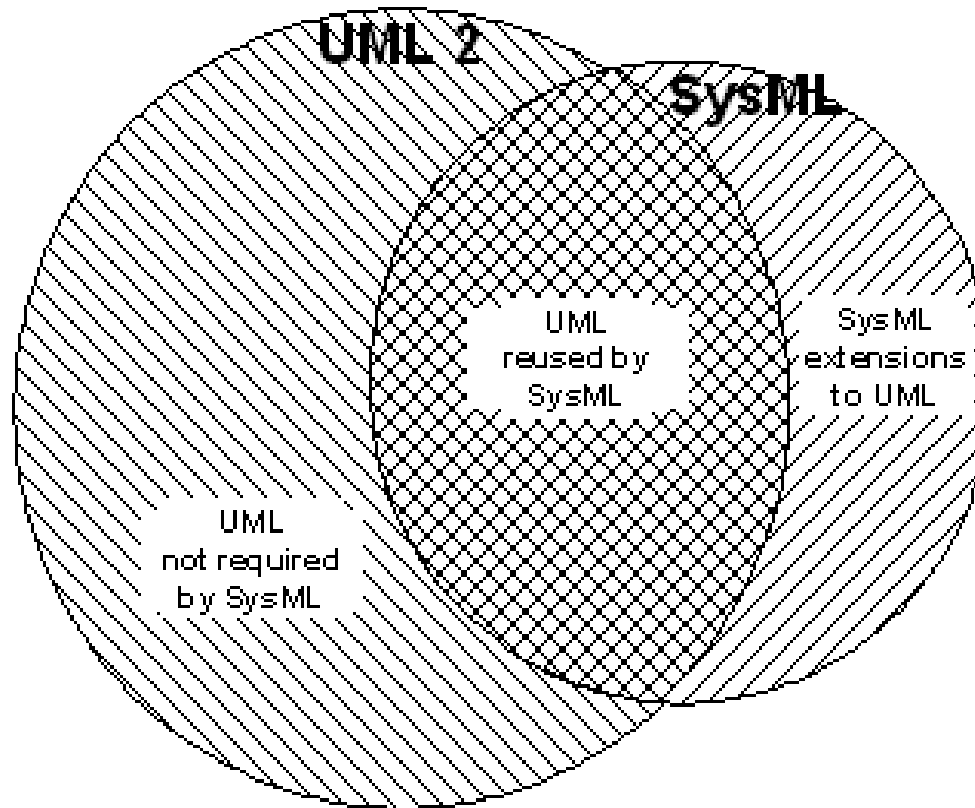
OMG RFP Summary

- Structure
 - e.g., system hierarchy, interconnection
- Behavior
 - e.g., function-based behavior, state-based behavior
- Properties
 - e.g., parametric models, time property
- Requirements
 - e.g., requirements hierarchy, traceability
- Verification
 - e.g., test cases, verification results
- Other
 - e.g., trade studies, spatial relationships

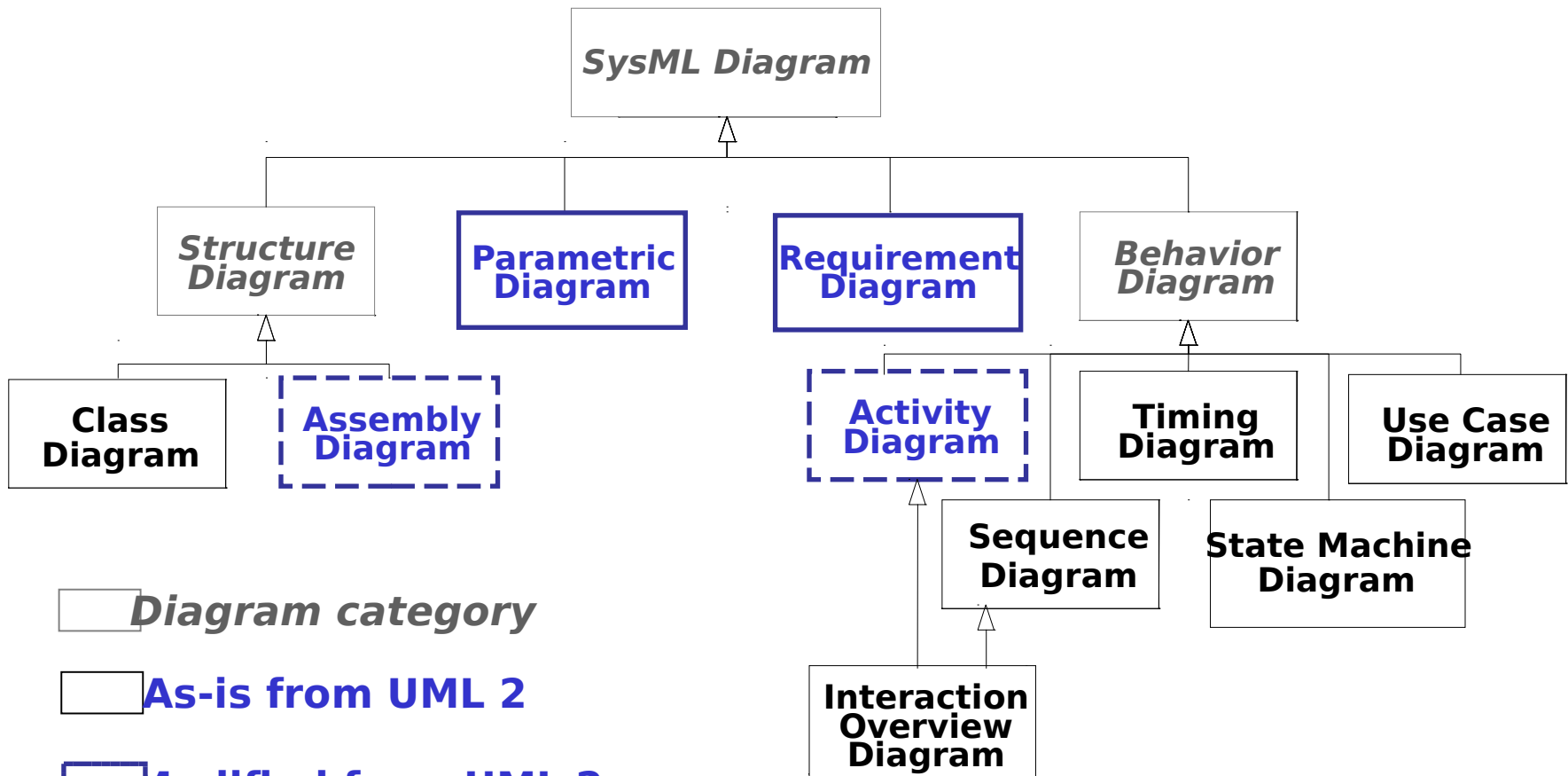
UML 2 Reuse

- Identify UML 2 subset needed to support the UML for SE RFP requirements and evaluation criteria
 - reduce tool implementation requirements for SE vendors
 - reduce training requirements for SE's
- SysML complements UML 2
 - Two languages can be used together by teams that include both software and system engineers

UML 2 Reuse



SysML Diagram Taxonomy



 **Diagram category**

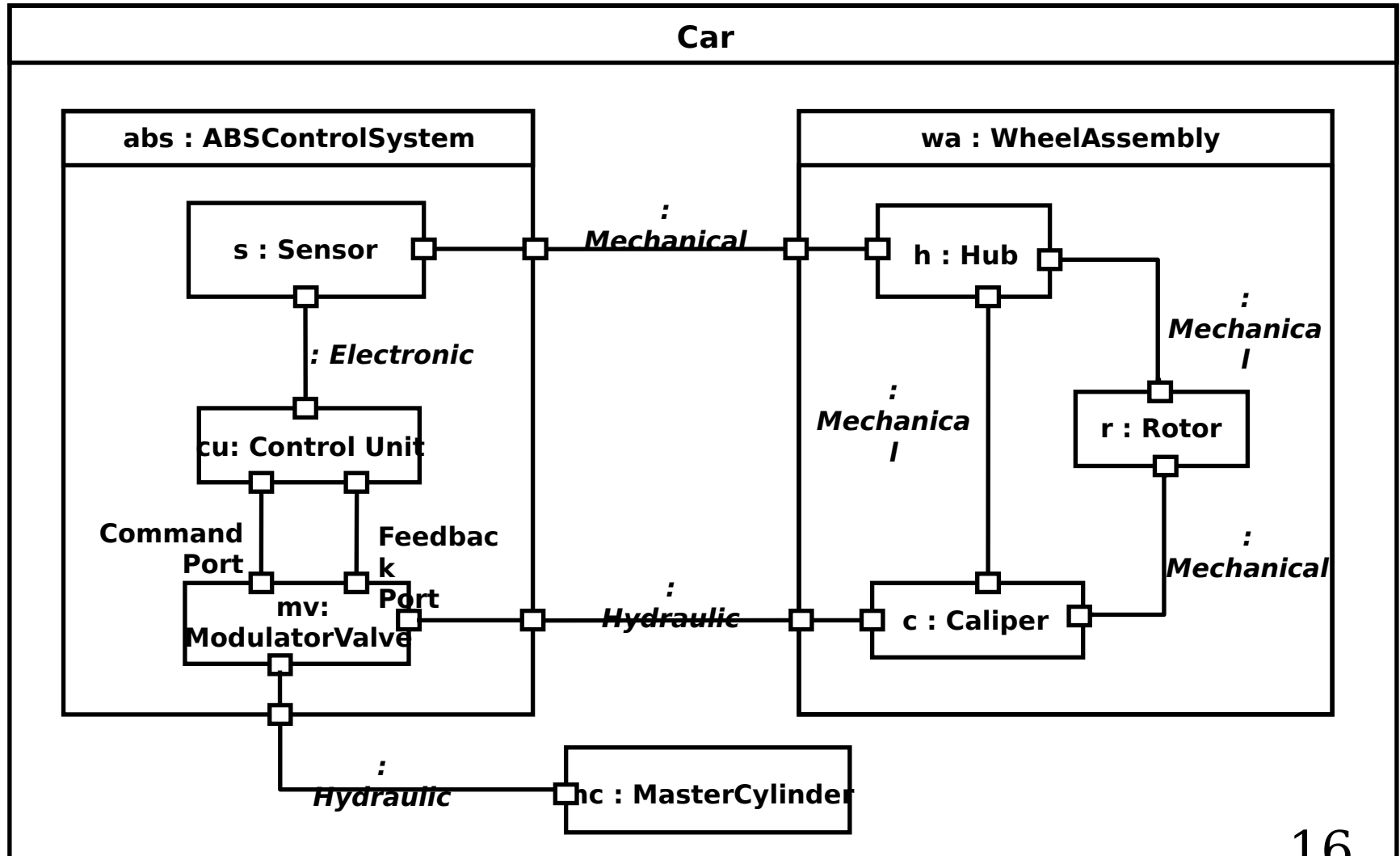
 **As-is from UML 2**

 **Modified from UML 2**

 **New diagram type**

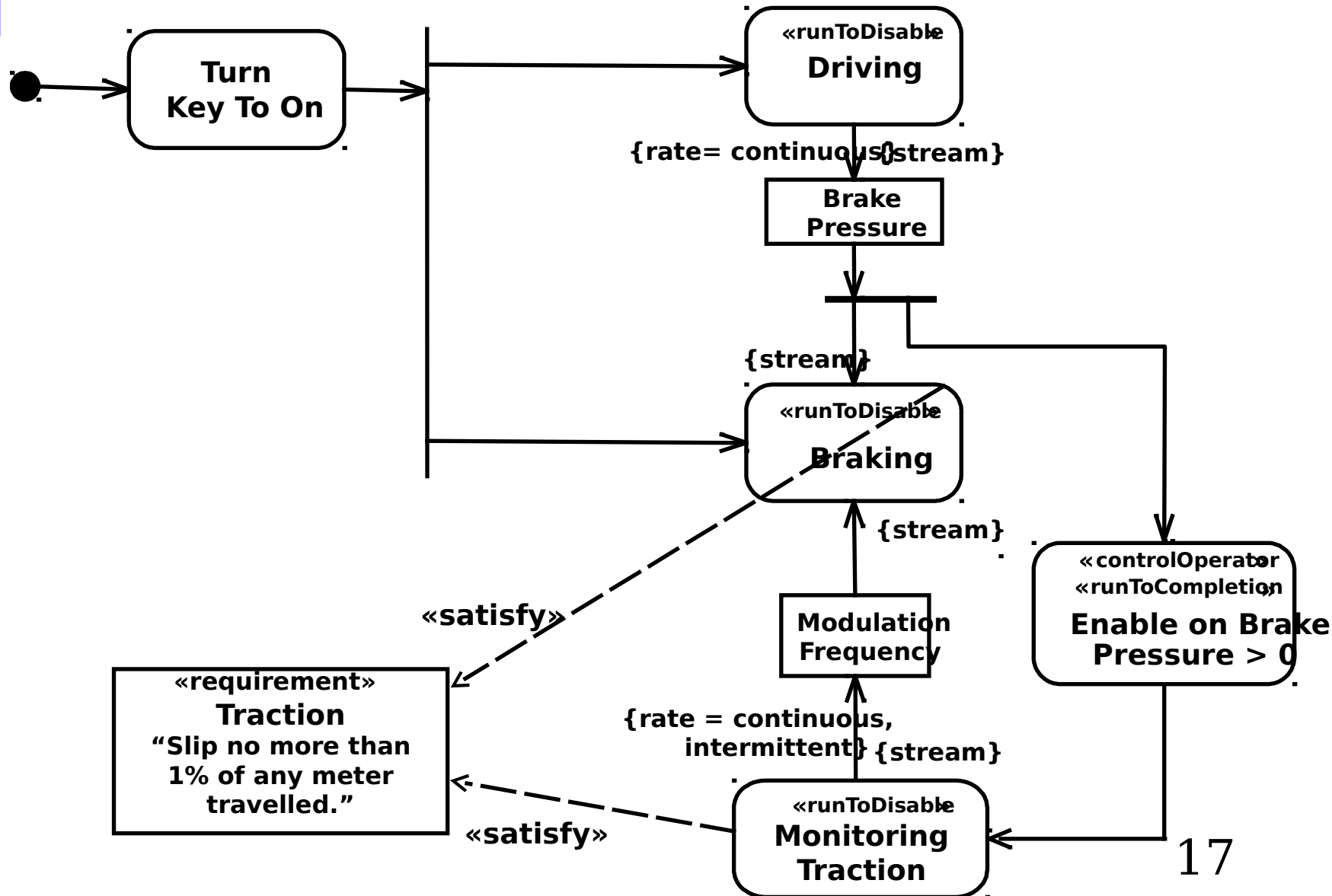
As of v0.90

Assemblies

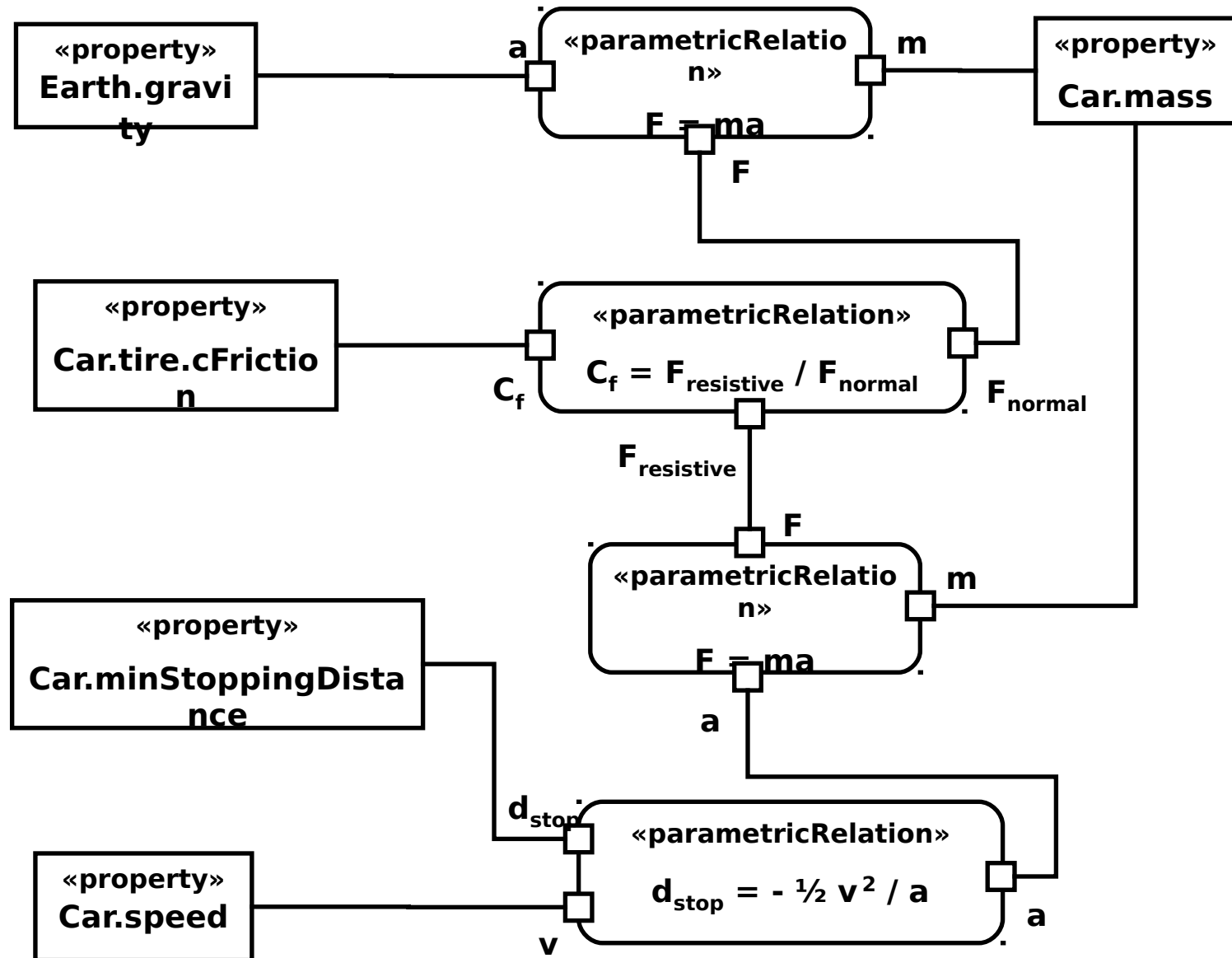


Activities

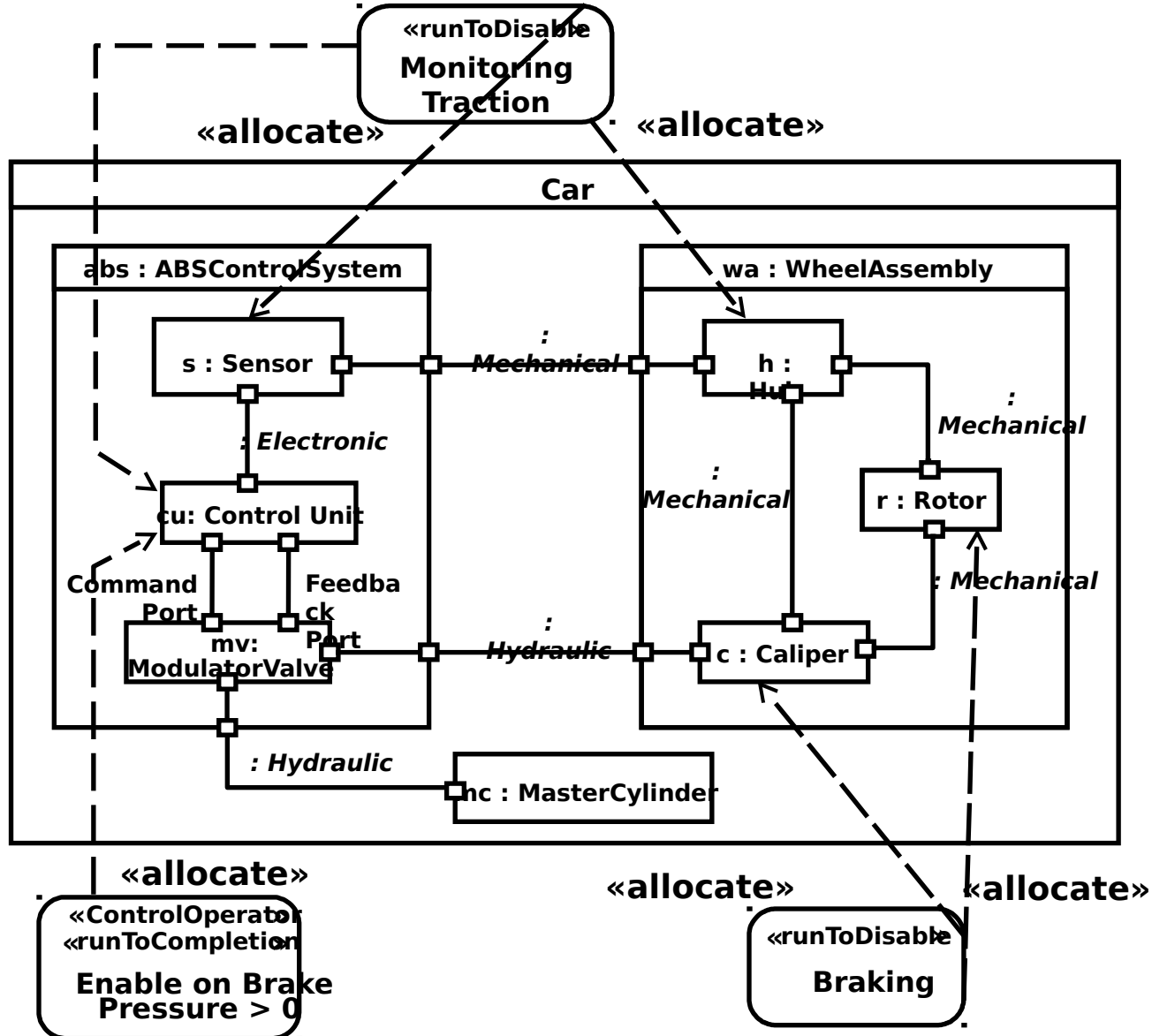
Bock, C., "UML 2 Activity Model Support for Systems Engineering Functional Flow Diagrams" INCOSE Journal, 6:4 (2003) & "SysML and UML 2 Support for Activity Modeling" to appear.



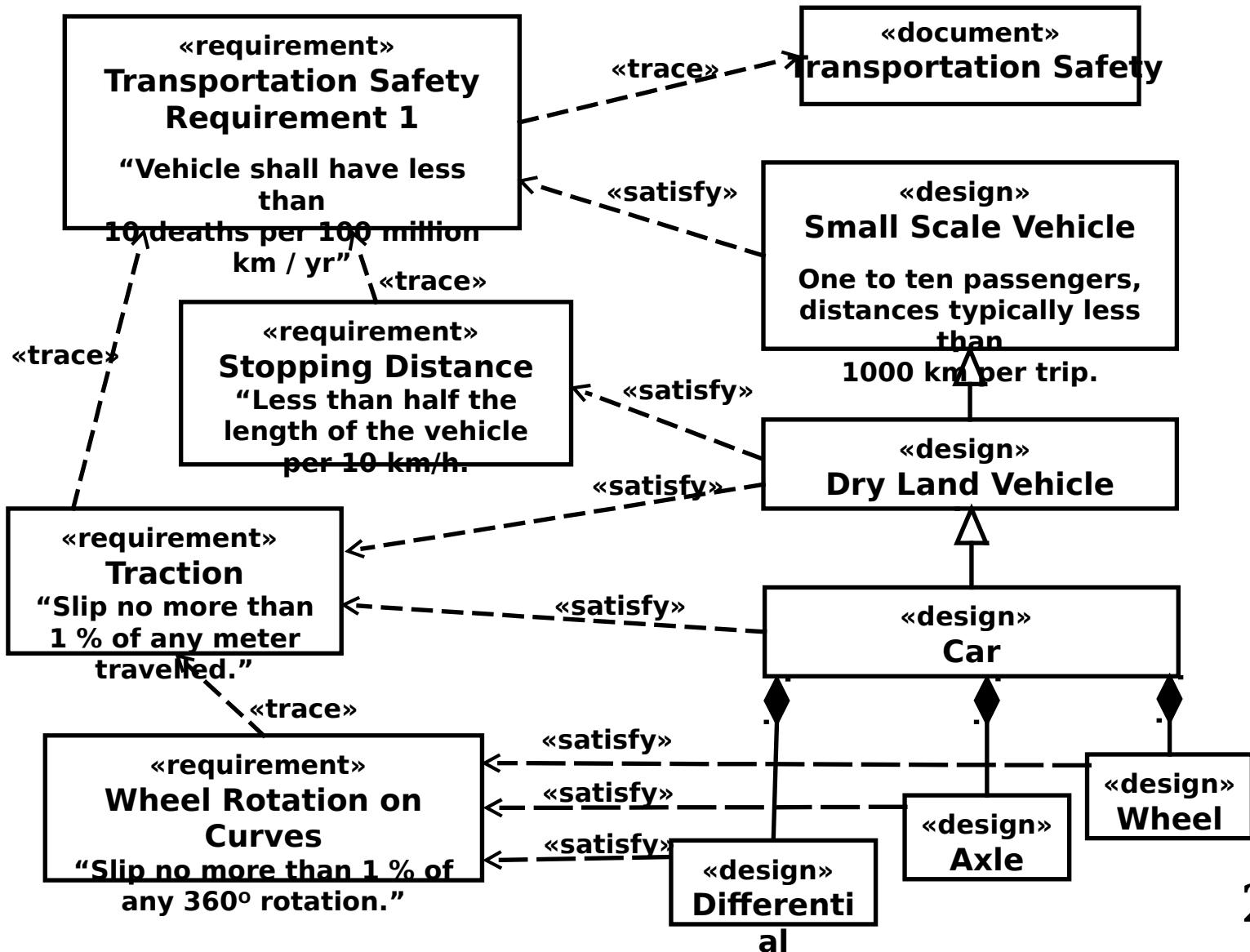
Parametrics



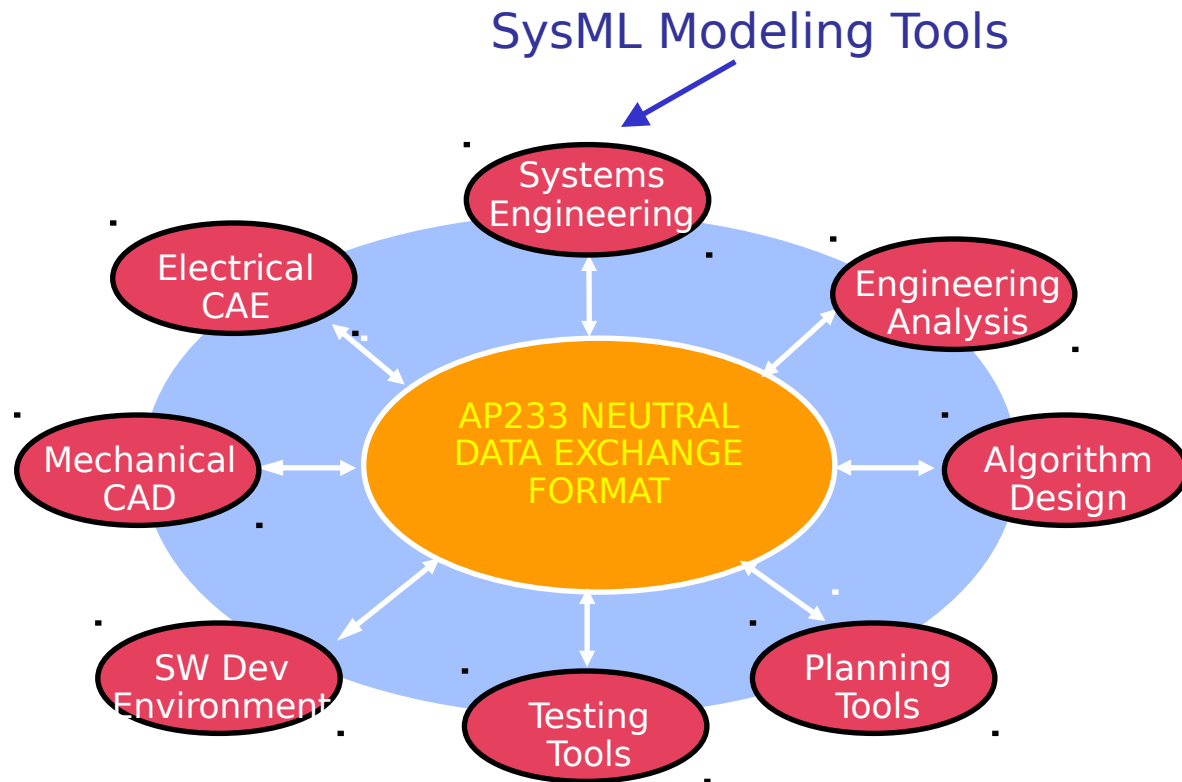
Allocation



Requirements



SysML and AP233 Alignment



Conclusion

- SE DSIG established as joint INCOSE/OMG initiative to
 - extend UML to support SE
 - align with AP233
- Broad collaboration established to respond to RFP
 - includes wide range of contributors from industry, tool vendors and government agencies
 - multiple stakeholder reviews
- SysML approach architecturally extends UML 2 Superstructure
 - reuses a subset of UML 2 “out of the box”
- Changes to UML 2 include:
 - enhancements to composite structure and activity diagrams
 - two new diagram types (requirements and parametrics)
 - other changes include allocation relationships and auxiliary constructs
 - Alignment with ISO AP233
- Working towards adoption of SysML v1.0 in Q1 2006
- Latest draft specification:
 - <http://www.omg.org/cgi-bin/doc?ad/05-01-03>